Neutrino Properties: preliminary bullet points and discussion topics

Neutrino mass:

- Absolute values of the neutrino masses are among the last unknown parameters of the (new/ν) Standard Model.
- KATRIN represents the state of the art of the presently available technology. It will reach its ultimate sensitivity (0.2 eV @ 90% C.L., 0.35 eV for a 5σ discovery) in the beginning of the next decade.
- This sensitivity is complementary to the precision available from the cosmological constraints and neutrinoless double-beta decay, available on a similar timescale.
- Techniques that may ultimately exceed this precision are in development: cyclotron radiation spectroscopy (Project-8), and bolometric micro-calorimeters (ECHO, HOLMES, etc). Significant R&D is required for the experimental implementations.

Questions:

- What is the ultimate reach of each approach, and on what timescale ?
- For experiments in the concept/proposal stage: what R&D is required to demonstrate the ultimate sensitivity ?
- Are there any technological advances that can be leveraged to improve the sensitivity by another one or two orders of magnitude beyond KATRIN and on what timescale ?
- Is availability of isotopes an issue ? (c.f. NSAC subcommittee on isotopes)

Neutrino magnetic moment:

- Coherent scattering experiments are sensitive to the anomalous magnetic moment of the neutrino. Detection requires low energy thresholds and high-intensity neutrino sources, and thus there is complementarity with several other programs (neutrino scattering, dark matter detection)

Questions:

- What are the pros and cons of each approach to detecting coherent neutrino scattering ?
- What is the ultimate reach of each approach, and on what timescale ?
- What R&D is required and on what timescale ?

Majorana/Dirac nature of neutrinos (Neutrinoless Double-Beta Decay):

- Searches for NLDBD aim to discover whether Lepton Number is a fundamental symmetry of nature or is violated, and determine Dirac or Majorana nature of neutrinos. The current generation of experiments will search for NLDBD with a sensitivity to the effective Majorana mass of order 100 meV. The next generation of experiments will aim for an order of magnitude improvement in sensitivity.

- There is a tremendous diversity of available techniques and detector technologies. The US community is gearing towards selecting the leading candidates for one or more next-generation experiments, shepherded by the NSAC-NLDBD committee. A targeted program of R&D activities towards mature concepts of the next-generation experiment is one of the priorities identified by this committee.

Questions:

- What are the key milestones for the current experiments in the next 5 years ?
- What critical questions need to be answered before a next-generation experiment is ready for construction ? What essential R&D must be completed prior to the technology downselect in the next few years ?
- Are there any common threads in the required R&D between NLDBD experiments and other efforts in neutrino physics ?